

Pre AP Pre Calculus
5.7 Double Angle Properties

Name: _____
Date: _____ Period : _____

Find the exact values for $\sin 2x$, $\cos 2x$, and $\tan 2x$ under the given conditions:

1. $\sin x = -\frac{4}{5}$ and $\frac{3\pi}{2} < x < 2\pi$

$-\frac{24}{25}, -\frac{7}{25}, \frac{24}{7}$

2. $\sec x = -5$ and $\pi < x < \frac{3\pi}{2}$

$\frac{4\sqrt{6}}{25}, -\frac{23}{25}, -\frac{4\sqrt{6}}{23}$

For each equation, find:

- a) the general solution b) the particular values for $0 \leq x < 2\pi$ or $0 \leq \theta < 360^\circ$

3. $4\sin x \cos x = \sqrt{3}$

A. $\frac{\pi}{6} + \pi n = x$ B. $\frac{\pi}{6}, \frac{\pi}{3}, \frac{3\pi}{6}, \frac{4\pi}{3}$

$\frac{\pi}{3} + \pi n = x$

5. $\cos^2 \theta - \sin^2 \theta = -1$

A. $\frac{\pi}{2} + \pi n = x$ B. $\frac{\pi}{2}, \frac{3\pi}{2}$

7. $\frac{2\tan x}{1 - \tan^2 x} = \sqrt{3}$ B. $\frac{\pi}{6}, \frac{\pi}{3}, \frac{3\pi}{6}, \frac{5\pi}{3}$

$\frac{\pi}{6} + \frac{\pi}{2}n$

4. $4\sin x \cos x = -\sqrt{2}$

A. $\frac{3\pi}{8} + \pi n$ B. $\frac{5\pi}{8}, \frac{7\pi}{8}, \frac{13\pi}{8}, \frac{15\pi}{8}$

$\frac{5\pi}{8} + \pi n$

6. $1 - 2\sin^2 x = -\frac{1}{2}$

A. $\frac{\pi}{3} + \pi n$ B. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

$\frac{2\pi}{3} + \pi n$

8. $\frac{2\tan \theta}{1 - \tan^2 \theta} = -1$

B. $\frac{3\pi}{8}, \frac{7\pi}{8}, \frac{11\pi}{8}, \frac{15\pi}{8}$

$\frac{3\pi}{8} + \frac{\pi}{2}n$

Using the double angle properties, write an equation expressing:

9. $\tan 18x$ in terms of $\tan 9x$ $\frac{2\tan(9x)}{1 - \tan^2(9x)}$

10. $\cot 14x$ in terms of $\tan 7x$ $\frac{1 - \tan^2(7x)}{2\tan(7x)}$

11. $\cos 10x$ in terms of $\cos 5x$ and $\sin 5x$

$\cos^2(5x) - \sin^2(5x)$

12. $\sin 6x$ in terms of $\cos 3x$ and $\sin 3x$

$2\sin(3x)\cos(3x)$

13. $\cos 6x$ in terms of $\cos 3x$

$2\cos^2(3x) - 1$

14. $\cos 22x$ in terms of $\sin 11x$

$1 - 2\sin^2(11x)$

Simplify each expression using the double angle properties:

15. $\frac{\sin 2x}{2\sin x} = \cos x$

16. $2\cos 2y \cdot \sin 2y = \sin(4y)$

17. $1 - 2\sin^2 3k = \cos(6k)$

18. $\frac{2\tan\left(\frac{1}{2}x\right)}{1 - \tan^2\left(\frac{1}{2}x\right)} = \tan x$

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Prove each identity (Pick any 5):

19.
$$\frac{\cos 2x}{\cos x - \sin x} = \cos x + \sin x$$

21.
$$\tan x = \frac{1 - \cos 2x}{\sin 2x}$$

22.
$$\cos 2x = \frac{1 - \tan^2 x}{1 + \tan^2 x}$$

23.
$$\sin 2x = 2 \cot x \sin^2 x$$

24.
$$\sin^2 x = \frac{1}{2}(1 - \cos 2x)$$

25.
$$\frac{\sin 2x}{1 + \cos 2x} = \tan x$$

26.
$$\frac{1}{2}(1 + \cos 2x) = \cos^2 x$$

27.
$$(1 + \tan x) \tan 2x = \frac{2 \tan x}{1 - \tan x}$$

28.
$$\cos^4 x - \sin^4 x = \cos 2x$$

29.
$$\sec 2x = \frac{1}{1 - 2 \sin^2 x}$$

30.
$$\frac{1 + \cos 2x}{\sin 2x} = \cot x$$